

## Section 6. Electricity

This section describes electrical energy sources; electricity consumed by end users (i.e., electricity sold to end users); estimates of the electrical system energy losses incurred in the generation, transmission, and distribution of electricity; and estimates of net interstate sales of electricity.

### Electrical Energy Sources

#### *Physical Units*

Electricity is produced from a number of energy sources. In the State Energy Data System (SEDS), coal, natural gas, and petroleum are measured in physical units of thousand short tons, million cubic feet, and thousand barrels, respectively, as they are consumed by the electric power sector. Since wood and waste are measured in a variety of physical units, they are converted to the equivalent heat content and entered into SEDS measured in British thermal units. Because comparable measures in physical units for nuclear power, hydroelectric, wood, waste, geothermal, wind, photovoltaic, and solar thermal energy sources are not available, energy output in the form of electricity produced from these energy sources, in million kilowatthours, is used instead. The variable names for these data are as follows ("ZZ" in the variable name represents the two-letter State code that differs for each State):

CLEIPZZ	= coal consumed by the electric power sector (described in Section 2 of this report), in thousand short tons;
ELEXPZZ	= electricity exported from the United States, in million kilowatthours;
ELIMPZZ	= electricity imported into the United States, in million kilowatthours;

GEEGPZZ	= electricity produced from geothermal energy by the electric power sector (described in Section 5), in million kilowatthours;
HYEGPZZ	= electricity produced from hydroelectric power in the electric power sector (described in Section 5), in million kilowatthours;
NGEIPZZ	= natural gas consumed by the electric power sector (described in Section 3), in million cubic feet;
NUEGPZZ	= electricity produced from nuclear power in the electric power sector, in million kilowatthours;
PAEIPZZ	= petroleum consumed by the electric power sector (described in Section 4), in thousand barrels;
SOEGPZZ	= electricity produced from photovoltaic and solar thermal energy sources in the electric power sector (described in Section 5), in million kilowatthours;
WDEIBZZ	= wood energy sources consumed by the electric power sector (described in Section 5), in billion Btu;
WSEIBZZ	= waste energy sources consumed by the electric power sector (described in Section 5), in billion Btu; and
WYEGPZZ	= electricity produced from wind energy by the electric power sector (described in Section 5), in million kilowatthours.

The U.S. totals for these series are calculated as the sum of the State data.

#### *British Thermal Units (Btu)*

In order to total all the energy that is used to produce electricity, the energy sources are converted to the common unit of Btu. The methods for calculating the Btu content of coal, natural gas, petroleum, and renewable energy sources consumed for generating electric power are explained in their respective sections of this documentation. Nuclear electric power is described in the following section.

A total of all energy consumed by the electric power sector, including imports and exports of electricity across U.S. borders, is calculated by the following formulas for each State and for the United States:

$$\begin{aligned} \text{TEEIBZZ} &= \text{PAEIBZZ} + \text{NGEIBZZ} + \text{CLEIBZZ} + \text{HYEGBZZ} + \\ &\quad \text{NUEGBZZ} + \text{GEEGBZZ} + \text{WWEIBZZ} + \text{WNEGBZZ} \\ &\quad + \text{ELNIBZZ} \\ \text{TEEIBUS} &= \Sigma \text{TEEIBZZ} \end{aligned}$$

## Nuclear Electric Power

Electricity generated from nuclear power, in million kilowatthours, by both regulated electric utilities and nonutility power producers are included in the State Energy Data System (SEDS) electric power sector. In the following formulas, “ZZ” in the variable name represents the two-letter State code that differs for each State:

$$\text{NUEGPZZ} = \text{electricity produced from nuclear power in the electric power sector, in million kilowatthours;}$$

The U.S. total is calculated as the sum of the State data:

$$\text{NUEGPUS} = \Sigma \text{NUEGPZZ}$$

Nuclear power used for generating electricity is the total nuclear energy, NUETP, included in EIA consumption data:

$$\begin{aligned} \text{NUETPZZ} &= \text{NUEGPZZ} \\ \text{NUETPUS} &= \text{NUEGPUS} \end{aligned}$$

The factor for converting electricity produced from nuclear energy (NUETKUS) is developed from data collected from nuclear steam-electric power plants. These U.S. average factors, which vary from year to year, can be found in Appendix B, Table B1, [http://www.eia.doe.gov/emeu/states/seds\\_updates\\_tech\\_notes.html](http://www.eia.doe.gov/emeu/states/seds_updates_tech_notes.html).

$$\text{NUETKUS} = \text{factor for converting nuclear electricity from kilowatthours to Btu.}$$

The formulas for applying the nuclear factor are:

$$\begin{aligned} \text{NUEGBZZ} &= \text{NUEGPZZ} * \text{NUETKUS} \\ \text{NUEGBUS} &= \Sigma \text{NUEGBZZ} \end{aligned}$$

$$\begin{aligned} \text{NUETBZZ} &= \text{NUEGBZZ} \\ \text{NUETBUS} &= \text{NUEGBUS} \end{aligned}$$

## Data Sources

NUEGPZZ — Electricity produced from nuclear power in the electric power sector by State.

- 1960 through 1977: Federal Power Commission, News Release, “Power Production, Fuel Consumption, and Installed Capacity Data,” table titled “Net Generation of Electric Utilities by State and Source.”
- 1978 through 1980: Energy Information Administration (EIA), *Energy Data Reports*, “Power Production, Fuel Consumption and Installed Capacity Data,” table titled “Net Generation of Electric Utilities by State and Source” (1978) and Table 36 (1979 and 1980).
- 1981 through 1985: EIA, Form EIA-759, “Monthly Power Plant Report,” and predecessor forms. Data are published in the EIA, *Electric Power Annual 1985*, Table 6.
- 1986 forward: EIA, Form EIA-906, “Power Plant Report,” and predecessor forms, <http://www.eia.doe.gov/cneaf/electricity/page/data.html>.

NUETKUS — Factor for converting electricity produced from nuclear power from physical units to Btu.

- 1960 through 1984: Calculated annually by the EIA by dividing the total heat content consumed in reactors at nuclear plants by the total (net) electricity generated by nuclear plants. The heat content and electricity generation are reported on FERC Form 1, “Annual Report of Major Electric Utilities, Licensees, and Others” and Form EIA-412, “Annual Report of Public Electric Utilities,” and predecessor forms. The factors for 1982 through 1984 are published in the following:
  - 1982: EIA, *Historical Plant Cost and Annual Production Expenses for Selected Electric Plants 1982*, page 215.

— 1983 and 1984: EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 13.

- 1985 forward: Calculated annually by EIA using the heat rate reported on Form EIA-860, “Annual Electric Generator Report” (and predecessor forms), and the generation reported on Form EIA-906, “Power Plant Report” (and predecessor forms).

## Electricity Imports and Exports

Electricity transmitted across U.S. borders with Canada and Mexico are included in the State Energy Data System (SEDS) electric power sector.

ELEXPZZ = electricity exported from the United States by State, in million kilowatthours;  
ELIMPZZ = electricity imported into the United States by State, in million kilowatthours;

State-level imports and exports are summed to give U.S. totals and exports of electricity are subtracted from imports to derive net imports:

ELIMPUS =  $\Sigma$ ELIMPZZ  
ELEXPUS =  $\Sigma$ ELEXPZZ

ELNIPZZ = ELIMPZZ – ELEXPZZ  
ELNIPUS =  $\Sigma$ ELNIPZZ

Imports and exports of electricity in million kilowatthours are converted to billion Btu by multiplying the physical unit data by the conversion factor of 3.412 thousand Btu per kilowatthour.

ELIMBZZ = ELIMPZZ \* 3.412  
ELIMBUS =  $\Sigma$ ELIMBZZ  
ELEXBZZ = ELEXPZZ \* 3.412  
ELEXBUS =  $\Sigma$ ELEXBZZ

ELNIBZZ = ELIMBZZ – ELEXBZZ  
ELNIBUS =  $\Sigma$ ELNIBZZ

## Data Sources

ELEXPZZ — Electricity exported from the United States (assumed to be produced by hydroelectric power through 1988) by State.

- 1960 through 1981: Economic Regulatory Administration, *Staff Reports*, “Report on Electric Energy Exchanges with Canada and Mexico.” Source data are arranged by the Regional Reliability Council Areas and then by the electric utility. State data were tabulated by aggregating the data of all electric utilities within each State.
- 1982 and 1983: Energy Information Administration (EIA) State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data.” State estimates are consistent with national and regional totals published in the ERA, *Electricity Exchanges Across International Borders*.
- 1984 through 1987: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data,” the Federal Energy Regulatory Commission Form 1, and the Bonneville Power Administration Annual Report. State estimates are consistent with national and regional totals published in the ERA, *Electricity Transactions Across International Borders*.
- 1988 forward: EIA State estimates are based on data from DOE, Fossil Fuels, Fuels Programs, Office of Coal and Electricity, Form FE-781R, “Annual Report of International Electrical Export/Import Data,” and predecessor forms, and the Canada National Energy Board report, “Electricity Exports and Imports, Monthly Statistics for December....”

ELIMPZZ — Electricity imported into the United States (assumed to be produced by hydroelectric power through 1988) by State.

- 1960 through 1981: Economic Regulatory Administration, *Staff Reports*, “Report on Electric Energy Exchanges with Canada and Mexico.” Source data are arranged by the Regional Reliability Council Areas and then by the electric utility. State data were tabulated by aggregating the data of all electric utilities within each State.
- 1982 and 1983: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data.” State estimates are

consistent with national and regional totals published in the ERA, *Electricity Exchanges Across International Borders*.

- 1984 through 1987: EIA State estimates are based on data from Economic Regulatory Administration Form ERA-781R, “Annual Report of Electrical Export/Import Data,” the Federal Energy Regulatory Commission Form 1, and the Bonneville Power Administration Annual Report. State estimates are consistent with national and regional totals published in the ERA, *Electricity Transactions Across International Borders*.
- 1988 forward: EIA State estimates are based on data from DOE, Fossil Fuels, Fuels Programs, Office of Coal and Electricity, Form FE-781R, “Annual Report of International Electrical Export/Import Data,” and predecessor forms, and the Canada National Energy Board report, “Electricity Exports and Imports, Monthly Statistics for December...”

## Electricity Consumed by the End User

### Physical Units

The amount of electricity sold to end users is considered to be the amount of electricity consumed by the end-use sectors. Six electricity sales data series, in physical units of million kilowatthours, are used to estimate consumption of electricity by end-use sector:

- ESRCPZZ = electricity sold to the residential sector of each State;  
 ESCMPZZ = a portion of the electricity sold to the commercial sector of each State;  
 ESICPZZ = electricity sold to the industrial sector of each State;  
 ESACPZZ = electricity sold to the transportation sector of each State (2003 forward);  
 ESOTPZZ = electricity sold to “Other” users (i.e., public street and highway lighting, other public authorities, railroads and railways, and interdepartmental sales) in each State (1960 through 2002); and  
 ESTRPZZ = electricity consumed by transit systems, in each State (1960 through 2002).

U.S. totals for the six State-level series are calculated as the sum of the State data.

The sales of electricity to the residential and industrial sectors from the source database are used directly as consumption of electricity by these sectors.

Commercial electricity consumption is estimated as the sum of sales to the commercial sector and the portion of sales to the “Other” sector that is not used for transportation:

$$\begin{aligned} \text{ESCCPZZ} &= \text{ESCMPZZ} + \text{ESOTPZZ} - \text{ESTRPZZ} \\ \text{ESCCPUS} &= \Sigma \text{ESCCPZZ} \end{aligned}$$

From 2003 forward, transportation electricity sales data are taken directly from the Energy Information Administration (EIA) *Electric Sales and Revenues* database. From 1960 through 2002, consumption of electricity for transportation, ESACPZZ, is equal to the electricity consumed by transit systems, ESTRPZZ, from the U.S. Department of Transportation, Federal Transit Administration.

Total electricity consumed is represented by ESTCPZZ and is calculated by adding the four end-use sector estimates:

$$\begin{aligned} \text{ESTCPZZ} &= \text{ESRCPZZ} + \text{ESCCPZZ} + \text{ESICPZZ} + \text{ESACPZZ} \\ \text{ESTCPUS} &= \Sigma \text{ESTCPZZ} \end{aligned}$$

### British Thermal Units (Btu)

Electricity consumption estimates are converted into Btu by applying a constant factor of 3.412 thousand Btu per kilowatthour as illustrated in the formulas:

$$\begin{aligned} \text{ESRCBZZ} &= \text{ESRCPZZ} * 3.412 \\ \text{ESTCBZZ} &= \text{ESTCPZZ} * 3.412 \end{aligned}$$

U.S. totals for the Btu series are calculated as the sum of the State data.



## Additional Calculations

Beginning in 2003, electricity sold for transportation use is available from the EIA *Electric Sales and Revenues* database. For years prior to 2003, additional calculations are performed in the State Energy Data System (SEDS) to provide data for the EIA *Monthly Energy Review* and *Annual Energy Review* to use in estimating transportation electricity use. The share of electricity sold to the “Other” category of consumers that is used for transportation is calculated:

$$\text{ESTRSUS} = \text{ESTRPUS} / \text{ESOTPUS}$$

## Additional Notes on Electricity Sales

- Beginning in 2003, the source for electricity consumed by the transportation sector is the EIA Form EIA-861, “Annual Electric Power Industry Report.” This is the first year that electricity sales data are collected separately for the transportation sector (previously these volumes were included in Commercial and “Other”). Information from the National Transit Data (NTD) System is used to supplement the EIA data for States with missing or incomplete volumes. Specifically, the following States did not report electricity consumed for battery recharging to EIA: Alabama, Iowa, Maine, Mississippi, and Tennessee. In addition, the following States did not report electricity consumed for propulsion: Missouri, Oregon, and Wisconsin. Finally, Ohio under-reported electricity consumed for propulsion. Missing facility data are obtained from the NTD System.
- The source for the electricity sales data for 1960 through 1983 is the EIA Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Electricity sales data for 1984 forward are from Form EIA-861, “Annual Electric Utility Report.” At the national level, data from both forms correspond closely (within 3 percent) for all end-use sectors. However, differences in the number of survey respondents and the reporting of commercial and industrial sales caused inconsistencies between 1983 and 1984 data in those end-use sectors for some States. See the EIA’s, *Electric Power Annual, 1991*, DOE/EIA-0348(91), p. 130, and *An Assessment of the Quality of Selected EIA Data Series, Electric Power Data*, DOE/EIA-0292(87), pp. 17–28, for detailed discussions of the reporting differences.
- The source for the electricity sales data for 1960 through 1983 is the EIA Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Electricity sales data for the District of Columbia and Maryland are combined on those forms. Estimates of separate sales for the District of Columbia and Maryland were created by using electricity sales data by end-use sector by communities from the FERC Form 1, “Annual Report of Major Electric Utilities, Licensees, and Others,” filed by the Potomac Electric Power Company (PEPCO). PEPCO sales to the District of Columbia were assumed to be total electricity sales in the District of Columbia. Electricity sales to the District of Columbia reported by PEPCO on the FERC Form 1 were subtracted from the EIA-826 District of Columbia and Maryland aggregate figures to obtain estimates of Maryland electricity sales by sector. Beginning with 1981 data, electric utilities were no longer required to report sales to specific communities. Therefore, sales data for the District of Columbia for 1981 through 1983 were obtained directly from PEPCO’s accounting department.

## Data Sources

ESACPZZ — Electricity consumed by the transportation sector by State.

- 1960 through 2002: Equal to ESTRPZZ.
- 2003: EIA, “Historical EPA Electric Sales and Revenue Spreadsheets” (January 5, 2006), [http://www.eia.doe.gov/cneaf/electricity/epa/sales\\_state.xls](http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls), sector name “Total Electric Industry”, column “Transportation Sales.” In 2003, data from the U.S. Department of Transportation, National Transit Database, <http://www.ntdprogram.com>, (click on “Publications” and then “Data Tables”) is used for the following States: Alabama, Iowa, Maine, Missouri, Mississippi, Ohio, Oregon, Tennessee, and Wisconsin. See Additional Note 1 on page 101.

ESCMPZZ — A portion of the electricity sold to the commercial sector by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Additional Note 3 on page 101.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, “Sales of Electric Energy to Ultimate Consumers.”

- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 125.
- 1981 through 1983: EIA, Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, “Annual Electric Utility Report.” Unpublished data.
- 1987: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual 1988*, Table 19.
- 1988 and 1989: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual*, Table 27.
- 1990 forward: EIA, “Historical EPA Electric Sales and Revenue Spreadsheets” (January 5, 2006), [http://www.eia.doe.gov/cneaf/electricity/epa/sales\\_state.xls](http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls), sector name “Total Electric Industry,” column “Commercial Sales.”

ESICPZZ — Electricity consumed by the industrial sector by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Additional Note 3 on page 101.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, “Sales of Electric Energy to Ultimate Consumers.”
- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 126.
- 1981 through 1983: EIA, Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, “Annual Electric Utility Report.” Unpublished data.
- 1987: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual 1988*, Table 19.
- 1988 and 1989: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual*, Table 27.
- 1990 forward: EIA, “Historical EPA Electric Sales and Revenue Spreadsheets” (January 5, 2006), [http://www.eia.doe.gov/cneaf/electricity/epa/sales\\_state.xls](http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls), sector name “Total Electric Industry,” column “Industrial Sales.”

ESOTPZZ — Electricity sold to the “Other” sector (i.e., public street and highway lighting, sales to other public authorities, railroads and railways, and interdepartmental sales) by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Additional Note 3 on page 101.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, “Sales of Electric Energy to Ultimate Consumers.”
- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 127.
- 1981 through 1983: EIA, Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, “Annual Electric Utility Report.” Unpublished data.
- 1987: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual 1988*, Table 19.
- 1988 and 1989: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual*, Table 27.
- 1990 through 2002: EIA, “Historical EPA Electric Sales and Revenue Spreadsheets” (January 5, 2006), [http://www.eia.doe.gov/cneaf/electricity/epa/sales\\_state.xls](http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls), sector name “Total Electric Industry,” column “Other Sales.”
- 2003 forward: Series discontinued. Values are assumed to be zero.

ESRCPZZ — Electricity consumed by the residential sector by State.

Note: Data for Maryland and the District of Columbia were combined for 1960 through 1983. The method for disaggregating the data is explained in Additional Note 3 on page 101.

- 1960 through 1975: Federal Power Commission, *Electric Power Statistics*, “Sales of Electric Energy to Ultimate Consumers.”
- 1976 through 1980: EIA, *Electric Power Annual* (November 1982), Table 124.
- 1981 through 1983: EIA, Form EIA-826, “Electric Utility Company Monthly Statement,” and predecessor forms. Published data rounded to gigawatthours in EIA, *Electric Power Annual 1983*, Table 51.
- 1984 through 1986: EIA, Form EIA-861, “Annual Electric Utility Report.” Unpublished data.
- 1987: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual 1988*, Table 19.

- 1988 and 1989: EIA, Form EIA-861, “Annual Electric Utility Report.” Published in the EIA, *Electric Power Annual*, Table 27.
- 1990 forward: EIA, “Historical EPA Electric Sales and Revenue Spreadsheets” (January 5, 2006), [http://www.eia.doe.gov/cneaf/electricity/epa/sales\\_state.xls](http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls), sector name “Total Electric Industry,” column “Residential Sales.”

ESTRPZZ — Electricity consumed by transit systems by State.

Notes: The transit system data include electricity used to operate commuter rail, rapid rail, streetcars or light rail, cable cars, trolley-buses, motorbuses, automated guideways, inclined plane railways, and aerial tramways. These data do not include electricity used by Amtrak. These data are available on a fiscal year basis (July 1 through June 30) for 1979 through 1982 and for calendar years 1983 forward. Some data for 1979 through 1983 were adjusted by EIA on the basis of an analysis of historical trends. Electricity consumption for the District of Columbia for 1976 through 2002 is partially apportioned to Maryland and Virginia on the basis of electricity consumption data from the Washington Metropolitan Area Transit Authority.

- 1960 through 1978: EIA estimates are based on data from:
  - The American Public Transit Association (formerly the American Transit Association) annual operating reports.
  - Pushkarev, Boris S. and others, *Urban Rail in America*. (Bloomington, IN: Indiana University Press, 1982.)
  - U.S. Department of Transportation, *A Directory of Regularly Scheduled, Fixed Route, Local Public Transportation Service in Urbanized Areas Over 50,000 Population*, 1980 and 1981.
- 1979 through 1989: U.S. Department of Transportation, Urban Mass Transportation Administration, *National Urban Mass Transportation Statistics, Section 15 Annual Report*, table titled “Energy Consumption: Details by Transit System.”
  - 1979 and 1980: Table 2.13.1.
  - 1981 and 1982: Table 3.13.1.
  - 1983 through 1989: Table 3.12.
- 1990 through 2002: U.S. Department of Transportation, Federal Transit Administration, *Data Tables for the Section 15 Report Year*, <http://www.ntdprogram.com>, (click on “Publications” and then “Data Tables.”):
  - 1990: Table 2.12.
  - 1991: Table 13.
  - 1992 through 1997: Table 15.

— 1998: Table 16.

— 1999 through 2002: Table 17.

- 2003 forward: Series replaced by ESACPZZ. Values are zero.

## Estimates of Electrical System Energy Losses

### British Thermal Units (Btu)

Electrical system energy losses, identified by “LO,” include all losses incurred in the generation, transmission, and distribution of electricity, including plant use and unaccounted for quantities. Total losses for the United States, LOTCBUS, is assumed to be the difference between the total of all energy consumed by the electric power sector (TEEIBUS) and the total electricity sold to end users (ESTCBUS). Total losses for the United States is calculated in billion Btu as follows:

$$\text{LOTCBUS} = \text{TEEIBUS} - \text{ESTCBUS}$$

Because Alaska and Hawaii have no exchanges of electricity with other States, their electrical system energy losses are estimated as the difference between the sum of all energy consumed by the State’s electric power sector and the electricity sold within the State:

$$\text{LOTGBAK} = \text{TEEIBAK} - \text{ESTGBAK}$$

$$\text{LOTGBHI} = \text{TEEIBHI} - \text{ESTGBHI}$$

Individual State electrical system energy losses for the remaining States are estimated by a different method. The difference between each of the contiguous 48 States’ (including the District of Columbia) TEEIB series and ESTCB is not only the losses but also any net interstate flow of electricity that may occur between States. In some cases these net interstate flows are substantial. Therefore, an effort is made to estimate separately each State’s losses and net interstate flow. The methodology is to calculate the contiguous-48-State subtotal of losses and subtotal of sales; to create annual losses-to-sales ratios for the aggregate of the 48 States; and to apply the annual losses-to-sales ratios from the total 48 States to the individual 48 States’ sales to estimate their losses.

The following steps are performed to complete the losses estimates. A subtotal of losses in the contiguous 48 States, LOTCB48, is created by subtracting the Alaska and Hawaii losses from the total United States' losses:

$$\text{LOTCB48} = \text{LOTCBUS} - (\text{LOTGBAK} + \text{LOTGBHI})$$

A similar subtotal of electricity sales in the 48 States only, ESTCB48, is calculated:

$$\text{ESTCB48} = \text{ESTCBUS} - (\text{ESTGBAK} + \text{ESTGBHI})$$

The losses-to-sales ratio for the contiguous 48 States only, ELLSS48, is calculated:

$$\text{ELLSS48} = \text{LOTCB48} / \text{ESTCB48}$$

Over the 42-year period now covered in the State Energy Data System (SEDS), the ratio is fairly constant, with a slight downward trend. For 1960, the ratio is 2.5; for 1961 through 1983 the ratio is 2.4; for 1987 and 1988 the ratio is 2.2; and for 1984 through 1986 and 1989 forward the losses-to-sales ratio is 2.3.

The U.S. ratios are applied to each State's sales to the major end-use sectors and total sales (temporarily including Alaska, Hawaii, and the 48-State subtotal for processing convenience):

$$\begin{aligned}\text{LORCBZZ} &= \text{ESRCBZZ} * \text{ELLSS48} \\ \text{LOCCBZZ} &= \text{ESCCBZZ} * \text{ELLSS48} \\ \text{LOICBZZ} &= \text{ESICBZZ} * \text{ELLSS48} \\ \text{LOACBZZ} &= \text{ESACBZZ} * \text{ELLSS48} \\ \text{LOTGBZZ} &= \text{ESTGBZZ} * \text{ELLSS48}\end{aligned}$$

Alaska, Hawaii, and the contiguous 48-State subtotal are recalculated to their original estimates. The end-use losses for Alaska and Hawaii are created in proportion to each sector's share of the State's total electricity sales:

$$\begin{aligned}\text{LOTGBAK} &= \text{TEEIBAK} - \text{ESTGBAK} \\ \text{LOTGBHI} &= \text{TEEIBHI} - \text{ESTGBHI} \\ \text{LOTGB48} &= \text{LOTGBUS} - (\text{LOTGBAK} + \text{LOTGBHI})\end{aligned}$$

$$\text{LORGBAK(HI)} = (\text{ESRCBAK(HI)} / \text{ESTGBAK(HI)}) * \text{LOTGBAK(HI)}$$

$$\text{LOCCBAK(HI)} = (\text{ESCCBAK(HI)} / \text{ESTGBAK(HI)}) * \text{LOTGBAK(HI)}$$

$$\text{LOICBAK(HI)} = (\text{ESICBAK(HI)} / \text{ESTGBAK(HI)}) * \text{LOTGBAK(HI)}$$

$$\text{LOACBAK(HI)} = (\text{ESACBAK(HI)} / \text{ESTGBAK(HI)}) * \text{LOTGBAK(HI)}$$

Losses for the United States, including Alaska and Hawaii, are the sums of all the States' losses.

### Physical Units

Estimates of losses in physical units of million kilowatthours are made by dividing the Btu estimate by the constant 3.412 thousand Btu per kilowatt-hour as illustrated in the following formulas:

$$\begin{aligned}\text{LORCPZZ} &= \text{LORCBZZ} / 3.412 & \text{LORCPUS} &= \text{LORCBUS} / 3.412 \\ \text{LOTCPZZ} &= \text{LOTGBZZ} / 3.412 & \text{LOTCPUS} &= \text{LOTGBUS} / 3.412\end{aligned}$$

## Net Interstate Flow of Electricity

### British Thermal Units (Btu)

An estimate of the net interstate flow of electricity is calculated as the difference between the total electricity sales and attributed losses and the total energy consumption by the electric power sector within each State. The estimated net interstate flow of electricity (ELISB) for each State and the United States is calculated:

$$\begin{aligned}\text{ELISBZZ} &= (\text{ESTGBZZ} + \text{LOTGBZZ}) - \text{TEEIBZZ} \\ \text{ELISBUS} &= \Sigma \text{ELISBZZ}\end{aligned}$$

### Physical Units

Estimates of net interstate flow of electricity in physical units of million kilowatthours are calculated by dividing the Btu value by the constant 3.412 thousand Btu per kilowatt-hour:



ELISPZZ = ELISBZZ / 3.412  
ELISPUS = ΣELISPZZ

Positive net interstate flow for a State means that the amount consumed within the State (including attributed losses) is greater than the amount of energy consumed by the electric power sector in the State. That is, the

State is using more electricity than it generates and, therefore, is a net buyer from other States.

A negative number indicates that the State's consumption by the electric power sector is greater than the requirements for electricity within its own borders, and, therefore, it is a net seller of electricity to other States.